

HOSSEIN AMINI KAFIABAD

Room: MCS 3077, Durham University Upper Mountjoy Campus, Stockton Rd, Durham DH1 3LE

POSITIONS AND EDUCATION

Assistant Professor in Applied Mathematics, Durham University Department of Mathematical Sciences Group: Applied and Computational Mathematics	2022-
University Teacher in Mathematical Computing, University of Edinburgh School of Mathematics and Maxwell Institute for Mathematical Sciences	2020-2022
Postdoctoral Research Associate, University of Edinburgh School of Mathematics and Maxwell Institute for Mathematical Sciences Projects: Wave scattering in geostrophic turbulence, Stimulated loss of balance in the ocean Supervisor: Jacques Vanneste	2018-2019
PhD, McGill University (GPA 3.88/4) Department of Atmospheric and Oceanic Sciences Dissertation: Balance dynamics in rotating stratified turbulence Advisor: Peter Bartello	2012-2017
Research Assistant, George Haller's Group, McGill University Department of Mechanical Engineering Project: Detection of airflow disturbances using Lagrangian Coherent Structures Advisor: George Haller	2010-2012
MSc, University of Tehran (GPA 19.44/20 - highest) Department of Mechanical Engineering Research thesis: bubble dynamics in viscoelastic fluids	2008-2010
BSc, University of Tehran (GPA 17.90/20 - second highest) Department of Mechanical Engineering	2004-2008

SELECTED PUBLICATIONS

Geophysical Fluid Dynamics

- HosseinA Kafiabad and Jacques Vanneste. Computing lagrangian means. *Under revision for the Journal of Fluid Mechanics*, 2022. Preprint: <https://arxiv.org/pdf/2208.02682.pdf>
- Michael R Cox, Hossein A Kafiabad, and Jacques Vanneste. Inertia-gravity-wave diffusion by geostrophic turbulence: the impact of flow time dependence. *Under revision for the Journal of Fluid Mechanics*, 2022. Preprint: <https://arxiv.org/pdf/2207.09386.pdf>
- Olivier Asselin, William R Young, and Hossein A. Kafiabad. The energetics of inertial wave refraction. *In preparation*, 2022
- Hossein A Kafiabad. Grid-based calculation of the lagrangian mean. *Journal of Fluid Mechanics*, 940, 2022
- Hossein A. Kafiabad, Jacques Vanneste, and William R. Young. Wave-averaged balance: a simple example. *Journal of Fluid Mechanics*, 911:R1, 2021.
- Hossein A. Kafiabad, Jacques Vanneste, and William R. Young. Interaction of near-inertial waves with an anticyclonic vortex. *Journal of Physical Oceanography*, 05 Apr. 2021.

- M.A.C. Savva, H.A. Kafiabad, and J. Vanneste. Inertia-gravity-wave scattering by three-dimensional geostrophic turbulence. *Journal of Fluid Mechanics*, 916:A6, 2021 (selected for Focus on Fluids).
- Hossein A. Kafiabad, Miles A. C. Savva, and Jacques Vanneste. Diffusion of inertia-gravity waves by geostrophic turbulence. *Journal of Fluid Mechanics*, 869:R7, 2019
- Hossein A Kafiabad and Peter Bartello. Spontaneous imbalance in the non-hydrostatic boussinesq equations. *Journal of Fluid Mechanics*, 847:614–643, 2018.
- Hossein Amini Kafiabad and Peter Bartello. Rotating stratified turbulence and the slow manifold. *Computers & Fluids*, 151:23–34, 2017.
- Hossein A Kafiabad and Peter Bartello. Balance dynamics in rotating stratified turbulence. *Journal of Fluid Mechanics*, 795:914–949, 2016.

Nonlinear Dynamics and Coherent Structures

- Hossein Amini Kafiabad, Pak Wai Chan, and George Haller. Lagrangian detection of wind shear for landing aircraft. *Journal of Atmospheric and Oceanic Technology*, 30(12):2808–2819, 2013.
- Mergen H Ghayesh, Hossein A Kafiabad, and Tyler Reid. Sub-and super-critical nonlinear dynamics of a harmonically excited axially moving beam. *International Journal of Solids and Structures*, 49(1):227–243, 2012.

Non-Newtonian Fluids

- H Amini Kafiabad and K Sadeghy. Chaotic behavior of a single spherical gas bubble surrounded by a giesekus liquid: A numerical study. *Journal of Non-Newtonian Fluid Mechanics*, 165(13-14):800–811, 2010.
- Ali Ahmadpour, Hossein Amini-Kafiabad, Jila Samadi, and Kayvan Sadeghy. The rise of second harmonics in forced oscillation of gas bubbles in thixotropic fluids. *Nihon Reoroji Gakkaishi*, 39(3):113–117, 2011.

Numerical Methods

- H Amini Kafiabad and K Sadeghy. On the use of genetic algorithm for finding the neutral instability curve in plane poiseuille flow. *International Journal of Non-Linear Mechanics*, 45(7):691–698, 2010.

RESEARCH INTERESTS

Geophysical Fluid Dynamics	Rotating Stratified Turbulence
Numerical Analysis	Wave Dynamics
High-Performance Computing	Spectral Methods
Multi-timescale biofluids	Dynamical Systems

INVITED TALKS

Computing Lagrangian means without tracking particles Multiscale Dynamics in the Atmosphere and Ocean, Oberwolfach, Germany.	March 2022
Statistics of gravity waves shaped by balanced atmospheric flows SPARC Gravity Wave Symposium, Frankfurt, Germany.	March 2022
Wave-scattering in geostrophic turbulence Colloquium speaker at Courant Institute of Mathematical Sciences .	March 2021
Wave-averaged geostrophic balance Seminars in physical oceanography, University of Grenoble, France.	May 2020
Balance-imbalance decomposition in Boussinesq equations Institut für Atmosphäre und Umwelt, Goethe-Universität Frankfurt, Germany.	Oct 2018

GRANTS AND AWARDS

Efficient numerical methods for wave-action transport and scattering	2021
EPSRC grants (EP/W007436/1, joint application with Jacques Vanneste, amount: £77k)	
HPC-Europa3 Transnational Access programme (joint application with Costanza Rodda)	2020
Abdel-Meguid Fellowship, McGill University	2012-2013
Greville Smith Research Fellowship, McGill University	2010-2011
(Awarded to only one graduate student in the faculty of engineering each year)	
McGill Engineering Doctoral Award (MEDA)	2010-2013

CONFERENCE PRESENTATIONS

Interaction of near-inertial waves with an anticyclone	
Rotating Fluids, University of Oxford, UK.	Sept 2020
Scattering of inertia-gravity waves in geostrophic turbulencen	
Waves, Instabilities and Turbulence in Geophysical and Astrophysical Flows, Corsica.	July 2019
High-order balance-imbalance decomposition and interaction	
Scales and scaling cascades in geophysical systems, Hamburg, Germany.	April 2018
Quantification of spontaneous imbalance in rotating stratified turbulence	
Modelling Imbalance in the Atmosphere and Ocean, Banff, Canada.	April 2018
Generation of imbalance from balanced initial conditions in rotating stratified turbulence	
American Geophysical Union, San Francisco, US.	Dec 2016
Lagrangian detection of aerial turbulence for landing aircraft	
Meeting of the Canadian Applied and Industrial Mathematics Society, Toronto, Canada.	June 2012

SUPERVISORY ROLES

PhD student

Michael Cox (co-supervised with Jacques Vanneste, 2020-now)

MSc dissertation

Hari Madhukmar (2022), Cam Campbell (2021), Tianming Bai (2020), Alden Robertson (2020), John Barsotti (2019)

Undergraduate students (supervised their final year project)

Dylan Lyons, Harry Ashby, Yalda Jenbdar, Georgia Montgomery, Rory MacDonald, Bryan Tan Di Fung, Marium Raza, Sam Brossler and Sneha Sinha

REVIEWS FOR SCIENTIFIC JOURNALS

Journal of Fluid mechanics, Physical Review Fluids, Journal of Physical Oceanography, Quarterly Journal of the Royal Meteorological Society, Journal of Atmospheric and Oceanic Technology

COMPUTER SKILLS

High Performance Computing	MPI, OpenMP, NetCDF, Unix shell scripting
Programming	C++, FORTRAN, Python, MATLAB
Computer-aided assessment	Moodle Quiz system, Stack, CodeRunner
Online Teaching and marking	Zoom, MS Teams, Gradescope

VOLUNTEERING AND OUTREACH

Web officer and trustee of the Edinburgh Mathematical Society	2019- now
Organiser of waves and flows meeting, University of Edinburgh	2018-2019
Council member of Post Graduate Student Society of McGill University	2015-2016
Member of McGill Interfaith Student Council (MISC)	2015-2016
McGill Outdoors Club Cycling and Hiking Executive	2011-2013

TAUGHT COURSES

High-Performance Computing for Mathematicians (2021)

I presented this course for the first time at PhD level, where I taught different concepts and techniques involved in parallel computing through mathematical problems. I was the course organiser and lecturer, and my roles included: designing syllabus, assignments and projects.

Honours Differential Equations (2020, 2021)

Role: designing assignments and projects, organising computer labs, tutoring and marking

Python Programming (2019, 2020, and 2021)

I co-lectured this course for three years. My roles included: lecturing, designing projects, designing auto-assessed quizzes using CodeRunner, tutoring and marking

Numerical PDEs (2021)

Applied Stochastic Differential Equations (2020)

Mathematics of Climate (2019)